

of 20 different islands, besides 1,500 ethnographical objects. Dr. Hann contributes "Some Results of Recent Meteorological and Hypsometric Observations in Equatorial East Africa;" Col. Mason-Bey, a detailed account of Dar-fur; and Prof. Ratzel, a paper on the Formation of Fjörds in Inland Seas.

UNDER the title of "Some Heroes of Travel," the Society for Promoting Christian Knowledge has issued a volume by that versatile and successful compiler Mr. Davenport Adams. It contains the stories of Marco Polo, G. F. Ruxton (Mexico and the Rocky Mountains), Barth, T. W. Atkinson (Siberia and Central Asia), Miss Tinné, Mr. McGahan, Col. Warburton, (Australia), Major Burnaby, and Sir Samuel Baker. Mr. Adams seems to have done his work conscientiously, and the book is likely to interest youthful readers and those fond of tales of adventure.

VOL. v. of Dr. Robert Brown's "Countries of the World" (Cassell) includes Siberia, the Chinese Empire, Burmah, and the other countries of the Indo-Chinese peninsula, India and neighbouring countries, Central Asiatic States, Russian Central Asia, and Persia. The new volume is quite up to the mark of the previous ones, and the numerous illustrations are well selected.

M. E. S. ZEBALLOS, writing from Buenos Ayres to *L'Exploration*, states that he has returned from the exploration of the Pampas of the Argentine Republic, and instead of finding them the featureless dead level which they are usually described, he discovered majestic mountains, lakes, rivers, and other features, which will materially change the map of South America. M. Zeballos kept minute records of his expedition, topographical, descriptive, scientific, meteorological, &c., which we hope will be placed within the reach of European geographers.

IN the last number of the *Bulletin* of the Eastern Siberian (Iskutsk) Section of the Russian Geographical Society is the continuation of the Report of M. Tcherski of the results of his three years geological exploration of the neighbourhood of Lake Baikal.

THE fourth Belgian expedition, under Capt. Raemackers, had got well into Central Africa from Bagamoyo by the end of August.

THE FIRST DECADE OF THE UNITED STATES FISH COMMISSION—ITS PLAN OF WORK AND ACCOMPLISHED RESULTS, SCIENTIFIC AND ECONOMICAL¹

THERE are now no less than nine departments of the Government devoted, in part or wholly, to researches in pure and applied science—the Geological Survey, the Coast and Geodetic Survey, the Naval Observatory, the National Museum, the Department of Agriculture, the Entomological Commission, the Tenth Census, with its special agencies for the study of the natural resources of the country, the Smithsonian Bureau of Ethnology, and the Commission of Fish and Fisheries. The Smithsonian Institution, established upon an independent foundation, should also be mentioned, as well as the Medical Museum of the Army and the various laboratories under the control of the Army and Navy Departments.

The Geological Survey is not now carrying on any of the schemes of zoological and botanical investigation engaged in by its predecessors.

The work of the Entomological Commission and that of the Census, though of extreme importance, are limited in scope and duration, while that of the Agricultural Department is necessarily, for the most part, economical.

The work of the National Museum is chiefly confined to the study of collections made by Government Surveys, or individual collectors, as sent in to be reported upon.

The work of the Fish Commission, in one of its aspects, may perhaps be regarded as the most prominent of the present efforts of the Government in aid of aggressive biological research.

On the 9th of February, 1871, Congress passed a joint resolution which authorised the appointment of a Commissioner of Fish and Fisheries. Prof. Baird, at that time Assistant-Secretary of the Smithsonian Institution, was appointed, and entered at once upon his duties.

The summer of 1880 marks the tenth season of active work since its inception in 1871. The Fish Commission now fills a place tenfold more extensive and useful than at first. The present essay aims to show, in a general way, what it has done,

¹ Read before the American Association for the Advancement of Science, Boston, August 28, 1880, by G. Brown Goode.

is doing, and expects to do—its purposes, its methods, its results.

The work is naturally divided into three sections—

1. The systematic investigation of the waters of the United States and of the biological and physical problems which they present.—In making his original plans the Commissioner insisted that to study only the food-fishes would be of little importance, and that useful conclusions must needs rest upon a broad foundation of investigations purely scientific in character. The life-history of species of economic value should be understood from beginning to end, but no less requisite is it to know the histories of the animals and plants upon which they feed, or upon which their food is nourished; the histories of their enemies and friends, and the friends and foes of their enemies and friends, as well as the currents, temperatures, and other physical phenomena of the waters in their relation to migration, reproduction, and growth. A necessary accompaniment to this division is the amassing of material for research to be stored in the National and other Museums for future use.

2. The investigation of the methods of the fisheries of the past and present, and the statistics of production and commerce in fishery products.—Man being one of the chief destroyers of fish, his influence upon their abundance must be studied. Fishery methods and apparatus must be examined and compared with those of other lands, that the use of those which threaten the destruction of useful fishes may be discouraged, and that those which are inefficient may be replaced by others more serviceable. Statistics of industry and trade must be secured for the use of Congress in making treaties or imposing tariffs, to show to producers the best markets, and to consumers where and with what their needs may be supplied.

3. The introduction and multiplication of useful food-fishes throughout the country, especially in waters under the jurisdiction of the general Government, or those common to several States, none of which might feel willing to make expenditures for the benefit of the others.

Although activity in this direction may be regarded in the light of applied rather than pure scientific work, it is particularly important to the biologist, since it affords opportunities for investigating many new problems in physiology and embryology.

Since the important fisheries centre in New England the coast of this district has been the seat of the most active operations in marine research. For ten years the Commissioner, with a party of specialists, has devoted the summer season to work at the shore at various stations along the coast from Connecticut to Nova Scotia. A suitable place having been selected, a temporary laboratory is fitted up with the necessary appliances for collecting and study. In this are placed from ten to twenty tables, each occupied by an investigator, either an officer of the Commission or a volunteer. From 1873 to 1879 important aid was rendered by the Secretary of the Navy, who detailed for this service a steamer to be used in dredging and trawling, and this year the steamer built expressly for the Commission is employed in the same manner.¹

The regular routine of operations at a summer station includes all the various forms of activity known to naturalists: collecting along the shore, seining upon the beaches, setting traps for animals not otherwise to be obtained, and scraping with dredge and trawl the bottom of the sea at depths as great as can be reached by a steamer in a trip of three days. In the laboratory are carried on the usual structural and systematic studies, the preparation of museum specimens and of reports. Since the organisation of the Commission the deep-sea work and the investigation of invertebrate animals has been under the charge of Prof. Verrill, who had for many years before the Commission was established been studying independently the invertebrate fauna of New England.

In addition to what has been done at the summer station, more or less exhaustive investigations have been carried on by smaller parties on many parts of the coast and in interior waters.

¹ The number of dredging and trawling stations on record is as follows:—

1871. Wood's Holl	...	...	...	...	...	...	...	...	345
1872. Eastport	200 by hand, 36 by steamer	...	...	...	...	...	...	...	236
1873. Portland	...	...	...	...	...	...	...	...	149
1874. Noank	...	...	...	...	...	...	...	...	223
1875. Wood's Holl	...	...	...	...	...	...	...	...	169
1877. Salem	...	...	...	...	...	...	...	...	...
1877. Halifax	...	...	...	...	...	...	...	...	...
1878. Gloucester	...	...	...	...	...	...	...	...	378
1879. Provincetown	...	...	...	...	...	...	...	...	...

The number of seine hauls is about 600.

1,500

The fauna of the Grand Banks and other off-shore fishing-grounds has been partly explored. In 1872, 1873, and 1874 dredging was carried on from the Coast Survey steamer *Bache* by Prof. Packard and Mr. Cooke, Prof. Smith, Mr. Harger, and Mr. Rathbun. In 1879 Mr. H. L. Osborne spent three months in a cod-schooner collecting material on the Grand Banks, and Mr. N. P. Scudder as long a time on the Holibut Grounds of Davis's Straits.

A most remarkable series of contributions has been received from the fishermen of Cape Ann. When the Fish Commission had its head-quarters at Gloucester, in 1878, a general interest in the zoological work sprang up among the crews of the fishing-vessels, and since that time they have been vying with each other in efforts to find new animals. Their activity has been stimulated by the publication of lists of their donations in the local papers, and the number of separate lots of specimens received to the present time exceeds 800. Many of these lots are large, consisting of collecting-tanks full of alcoholic specimens. At least thirty fishing-vessels now carry collecting-tanks on every trip, and many of the fishermen, with characteristic superstition, have the idea that it insures good luck to have a tank on board, and will not go to sea without one. The number of specimens acquired in this manner is at least 50,000 or 60,000, most of them belonging to species otherwise unattainable. Each holibut vessel sets, twice daily, lines from ten to fourteen miles in length, with hooks upon them six feet apart, in water 1,200 to 1,800 feet in depth, and the quantity of living forms brought up in this manner, and which had never hitherto been saved, is very astonishing. Over thirty species of fishes have thus been added to the fauna of North America; and Prof. Verrill informs me that the number of new and extra-limital forms thus placed upon the list of invertebrates cannot be less than fifty.

A permanent collector, Mr. Vinal N. Edwards, has been employed at Wood's Holl and vicinity since 1871, and many remarkable forms have also been discovered by him. No dredging has yet been attempted by the Commission south of Long Island. Dr. Yarrow, Mr. Earle, and others, have collected from Cape May to Key West. The Gulf States Coast was explored last winter by a party conducted by Mr. Silas Stearns, who spent nine months in studying the food-fishes and useful invertebrates in behalf of the Commission and the Census. The entire Pacific coast has been scoured by Prof. Jordan for the Commission and the Census, and the ichthyology of that region has been enriched by the discovery of sixty species new to the fauna, forty of them being new to science. A similar investigation on the great lakes has been carried over a period of several years by the late Mr. Milner and Mr. Kumlien. The ichthyology of the rivers of the country has received much attention from the many experts employed by the Commission in fish-cultural work.

In addition to these local studies may be mentioned the general explorations such as are now being carried on for the oyster by Mr. Ernest Ingersoll and Mr. John F. Ryder, for the shad by Col. McDonald, for the smelt and the Atlantic salmon by Mr. C. G. Atkins, and the Quinnot salmon by Mr. Livingston Stone.

A partial indication of what has been accomplished may be found in the number of species added to the various faunal lists. Take, for instance, the cephalopod mollusks of New England, in Prof. Verrill's recently published monographs; twenty species are mentioned, thirteen of which are new to science. Ten years ago only three were known.

I am indebted to Prof. Verrill for the following estimate of the number of species added within the past ten years to the fauna of New England, mainly by the agency of the Commission:—

	Formerly known.	Additions.	Now known.
Crustacea	105	193	298
Pycnogonida	5	10	15
Annelida	67	238	305
Vermes	39	100	139
Mollusca	317	109	426
Echinodermata	47	41	88
Anthozoa or Polyps	20	35	55
Hydrozoa or Acalepha	102	78	180
Tunicata	26	25	51
Polyzoa	56	91	147
Brachiopoda	5	0	5
Sponges	10	80	90
	800	1,000	1,800

It is but just to say that many of these species were obtained by Prof. Verrill in the course of his independent explorations in Maine and Connecticut previous to 1871.

A similar estimate for the fishes indicates the discovery of at least 100 species on the Eastern Atlantic coast within ten years; half of these are new to science. Forty species have been added to the fauna north of Cape Cod; sixteen of these are new and have been found within three years. Seventeen have been described as new from the Gulf of Mexico. Sixty and more have been added upon the west coast. The results of the summer campaigns are worked in winter in the Peabody Museum of Yale College, under the direction of Prof. Verrill, and by the specialists of the National Museum.

One of the important features of the work is the preparation of life-histories of the useful marine animals of the country, and great quantities of material have been accumulated relating to almost every species. A portion of this has been published. More or less complete biographical monographs have been printed on the bluefish, the sculp, the menhaden, the salmon, and the whitefish, and others are nearly ready. Another monograph which may be referred to in this connection is that of Mr. Starbick on the whale-fishery, giving its history from the earliest settlement of North America.

The temperature of the water in its relation to the movements of fish has from the first received special attention. Observations are made regularly during the summer work, and at the various hatching-stations. At the instance of the commissioner, an extensive series of observations have, for several years, been made under the direction of the chief signal officer of the army, at lighthouses, light-ships, life-saving and signal stations, carefully chosen along the whole coast. This year thirty or more fishing schooners and steamers are carrying thermometers to record temperatures upon the fishing-grounds, a journal of the movements of the fish being kept at the same time. One practical result of the study of these observations has been the demonstration of the cause of the failure of the Menhaden fisheries on the coast of Maine in 1879—a failure on account of which nearly 2,000 persons were thrown out of employment. Another important series of investigations carried on by Commander Beardsley of the Navy shows the error of the ordinary manner of using the Casel-Miller deep-sea thermometer; still another series made by Dr. Kidder of the Navy, and to be carried out in future, had for its object the determination of the temperature of the blood of marine animals. Observations have also been made by Mr. Milner upon the influence of a change from sea water into fresh water, and from fresh water into sea water upon the young of different fishes. Mr. H. J. Rice carried on a series of studies upon the effect of cold in retarding the development of incubating fish-eggs. A series of analyses have been made by Prof. Atwater to determine the chemical composition and nutritive value of fish as compared with other articles of food. This investigation is still in progress. In connection with the work of fish-culture, much attention has been paid to embryology. The breeding times and habits of nearly all of our fishes have been studied and their relations to water temperatures. The embryological history of a number of species such as the cod, shad, alewife, salmon, smelt, Spanish mackerel, striped bass, white perch, and the oyster, have been obtained, under the auspices of the Commission, by Messrs. Brooks, Ryder, Schaeffer, Rice, and others.

The introduction of new species in water in which they were previously unknown is of special interest to the student of geographical distribution. Through the agency of the Commission the German carp has already been placed in nearly every State and Territory, although the work of distribution has only just begun, and the tench (*Tinca vulgaris*) and the golden orfe (*Idus melanotus*) have been acclimated; the shad has been successfully planted in the Mississippi valley and on the coast of California, and the California salmon in the rivers of the Atlantic slope. The lake whitefish of Europe has been introduced into a lake of Wisconsin. As an act of international courtesy, California salmon have been successfully introduced into New Zealand and Germany. The propagation work has increased in importance from year to year, as may be seen by the constant increase in the amount of the annual appropriation. A review of the results of the labours of the Commission in increasing the food supply of the country may be found in the annual reports. The rude appliances of fish-culture in use ten years ago have given way to scientifically devised apparatus, by which millions of eggs are hatched where only thousands were before, and the demonstration of the possibility of stocking rivers and lakes to any

desired extent has been greatly strengthened. This work was for six years most efficiently directed by the late Mr. James W. Milner, and is now in charge of Major T. B. Ferguson, also Commissioner for the State of Maryland, by whom has been devised the machinery for propagation on a gigantic scale, by the aid of steam, which is now so successfully in use.

The investigation of the statistics and history of the fisheries has perhaps assumed greater proportions than was at first contemplated. One of the immediate causes of the establishment of the Commission was the dissension between the line and net-fishermen of southern New England with reference to laws for the protection of the deteriorating fisheries of that region. The first work of Prof. Baird as Commissioner was to investigate the causes of this deterioration, and the report of that year's work includes much statistical material. In the same year a zoological and statistical survey of the great lakes was accomplished, and various circulars were sent out in contemplation of the preparation of monographic reports upon the special branches of the fisheries, some of which have already been published.

Some thirty trained experts are now engaged in the preparation of a statistical report on the present state and the past history of the fisheries of the United States. This will be finished next year, but the subject will hereafter be continued in monographs upon separate branches of the fisheries, such as the holoibut fishery, the mackerel fishery, the shad fishery, the cod fishery, the herring fishery, the smelt fishery, and various others of less importance.

Hundreds, and even thousands of specimens of a single species are often obtained. After those for the National Museum have been selected, a great number of duplicates remain. These are identified, labelled, and made up into sets for exchange with other museums and for distribution to schools and small museums. This is in accordance with the time-honoured usage of the Smithsonian Institution, and is regarded as an important branch of the work. Several specialists are employed solely in making up these sets and in gathering material required for their completion. Within three years fifty sets of fishes in alcohol, including at least ten thousand specimens, have been sent out, and fifty sets of invertebrates, embracing 175 species and 25,000 specimens. One hundred smaller sets of representative forms intended for educational purposes, to be given to schools and academies, are now being prepared. The arrangement of the invertebrate duplicates is in the charge of Mr. Richard Rathbun; of the fishes, in that of Dr. T. H. Bean. Facilities have also been given to many institutions for making collections on their own behalf. Six annual reports have been published, with an aggregate of 5,650 pages. These cover the period 1871 to 1878. Many papers relating to the work have been published elsewhere, particularly descriptions of new species and results of special faunal exploration.

The season of 1880 was opened by the participation of the Commission in the International Exhibition at Berlin. The first honour-prize, the gift of the Emperor of Germany, was awarded to Prof. Baird, not alone as an acknowledgment that the display of the United States was the most perfect and most imposing, but as a personal tribute to one who, in the words of the president of the Deutscher Fisherei Verein, is regarded in Europe as the first fish-culturalist in the world.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

OXFORD.—This year the term commences somewhat later than usual. The professorial lectures on natural science begin next week. At the University Museum Dr. Odling lectures on Typical Alcohols, Prof. Clifton on Experimental Electricity, Prof. Price on Hydro mechanics, Prof. Story-Maskelyne, M.P., on the Elements of Crystallography, Prof. Prestwich on Stratigraphical Geology, and Prof. Rolleston on Digestion.

Lectures are also given in the Chemical Department at the Museum by Mr. W. W. Fisher, on Inorganic Chemistry, by Mr. J. Watts on Organic Chemistry, and by Dr. F. D. Brown on Chemical Affinity. In the Biological Department Messrs. C. Robertson, W. H. Jackson, and A. F. Thomas form classes for instruction in Microscopy and Zoology. Mr. Barclay Thompson gives a course on the Comparative Anatomy of the Mammalia. In the Clarendon Laboratory Mr. Stocker lectures on Elementary Mechanics, and, with Mr. V. Jones, gives instruction in practical physics.

At the University Observatory Prof. Pritchard will lecture on

Spherical Astronomy, including instruments, and will give a course of six lectures on the Precession of the Equinoxes, including the Lunar Physical Libration. The Observatory is opened on Monday and Tuesday evenings during the term to members of the University who desire to obtain instrumental practice. In his annual report to the Board of Visitors the Professor gives an account of the work carried on during the past year at the Observatory. The long series of observations in reference to the Inequalities in the Moon's Rotation are now finished, and the results will be shortly published. The calculations were brought to a successful issue during the Long Vacation, and afford a general confirmation of the investigations of Bouvard, Nicollet, and Wichmann, and establish the existence of small but sensible inequalities in the moon's rotation. Careful measurements have also been made by Mr. Plummer of the relative positions of forty stars in the Pleiades, and Mr. Jenkins has measured the relative co-ordinates of 250 stars in the cluster 39 Messier. Careful observations have also been made of the component stars of ξ Ursæ Majoris and 70 Ophiuchi. With regard to the instruments the Professor writes:—

"The large refractor has been thoroughly examined and cleaned by Mr. Grubb, the artist who constructed it. This at present is in an efficient working condition in every respect. From our own resources we have thoroughly overhauled the De La Rue Reflector, and it also is in excellent condition. It is fortunate for the University that both these instruments pass from time to time under the experienced and critical eye of Dr. De La Rue himself. For a time Dr. De La Rue's metallic speculum was replaced by an excellent silvered glass mirror, executed by Mr. With; the newer mirror possessed the greater capacity of the two, in point of brilliancy of reflected light, but was not deemed quite equal to Dr. De La Rue's in point of definition; we have therefore returned to the use of the original speculum.

"In order to carry out a new and important series of astronomical observations I soon found that the use of a chronograph was indispensable; accordingly I have, in conjunction with Mr. Grubb, devised a very inexpensive but practically efficient form of that instrument. The total cost of this instrument, together with a corresponding and necessary addition to the mechanism of the sidereal clock, has not exceeded 10*l*. I am told on the best authority that this form of the chronograph will henceforth prove a desirable adjunct in other observatories.

"With the view of bringing practical astronomy within the reach of a moderate expenditure I have (again in conjunction with Mr. Grubb) devised a modification of existing small equatorial telescopes, which I anticipate will prove a boon to beginners in astronomical science.

"Lastly, I have devised and carried into execution a simple form of precessional globe for the use of students in astronomy. It affords very ready means of representing the risings and settings of the stars, and the general aspect of the heavens at the remotest periods of time, past and future, and as seen at any locality."

In the Botanic Garden Prof. Lawson will give instruction on the Minute Anatomy of the Vegetable Tissues.

The following lectures are given in those colleges which possess laboratories. At Christ Church Mr. Vernon Harcourt lectures on the Non-metallic Elements, and Mr. R. E. Baynes on Dynamical Electricity and Conduction of Heat. At Balliol College Mr. J. W. Russell lectures on Problems in Mechanics, and Mr. H. B. Dixon on Elementary Heat and Light. At Exeter College Mr. Lewis Morgan lectures on Practical Histology, and at Magdalen College Mr. C. J. Yule gives a course of demonstrations on the Chemical Composition of the Body.

AN examination for Natural Science Scholarships is being held by Trinity and Exeter Colleges. The former College has this year for the first time offered a scholarship for proficiency in science. At Merton College the science scholarship (Post-mastership) was not awarded.

At Balliol College there will be offered next month a science scholarship, on the foundation of Miss Brakenbury, open to all candidates without limitation of age, who shall not have exceeded eight terms from matriculation. The scholarship is of the annual value of 80*l*., and is tenable for four years during residence. Papers will be set in the following subjects:—(1) Mechanical Philosophy and Physics, (2) Chemistry, (3) Physiology. Candidates will not be expected to offer themselves in more than two of these. There will be a practical examination in one or more